

APPENDIX A

STANDARD OPERATING PROCEDURES

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Standard Operating Procedure 1

Navigation and Positioning Control

Work Vessel:

The work vessel may be one of several types available. The critical factors in selecting an appropriate vessel include adequate deck space for sampling equipment and sample process procedures, adequate power supply and cabin space for operation of equipment, and appropriate lifting capability for sampling equipment. To efficiently and safely conduct the work, the vessel must have the following equipment and features:

- all U.S. Coast Guard-mandated safety equipment, including life jackets for the crew and field crew members
- a functioning and calibrated depth finder (Fathometer)
- a winch, line, and boom or davit capable of handling at least five times the weight of the largest sediment sampler potentially used for the program, and with at least 4 feet of clearance over the stern or side of the vessel with the boom end a minimum of 10 feet above the rail. The largest potential piece of sampling equipment is the 0.2-square-meter Van Veen, which has a loaded weight of approximately 300 pounds
- an approved (rated) source of 120-volt AC, 60-Hz, 20-amp power for navigation equipment
- a seawater pump and deck hose for ambient water supply
- ample deck space for four field crew members, sediment sampling equipment, and benthic sampling and handling equipment (a minimum of approximately 100 square feet)
- an enclosed area adjacent to or part of the pilothouse for protection and operation of navigation equipment
- space for storage of sampling supplies, and shelter for crew during work breaks

- bathroom facilities

The captain of the vessel must have the necessary licensing and insurance for the project. The captain will be expected to review boating safety issues and emergency equipment with the vessel crew and field personnel. The captain and vessel crew will be provided with a copy of the Foster Wheeler Environmental Corporation Health and Safety Plan for the project and will be expected to abide by the provisions of the plan at all times during field activities. The field crew will rely on the experience and knowledge of the captain to determine if and when inclement weather conditions preclude planned daily sampling activities.

Navigation:

Horizontal positioning will be provided using a differential global positioning system (DGPS). The DGPS system provides horizontal accuracies on the order of ± 1 meter. This system uses two receivers. One receiver is positioned directly over the selected sampling location while the second differential receiver is used to generate differential corrections. These differential corrections can be generated by a base station established on site, by use of commercial corrections, or by use of U.S. Coast Guard (USCG) broadcast corrections.

The sample station receiver establishes the horizontal location of the station using information transmitted from the global positioning system (GPS) satellites. The differential receiver accepts real-time positioning signals from satellites in the GPS system and transmits offset corrections to the sampling station receiver based upon the known coordinates of the control point. The on-vessel system also can provide the range and bearing from one known station to another in order to guide the vessel operator. For work on a small or shallow-draft vessel, a hand-held DGPS device may serve as the sampling station receiver.

GPS positions are given in latitude and longitude using the 1984 World Geodetic System datum (WGS 84) created by the U.S. Defense Mapping Agency. This datum is essentially identical to the North American Datum (NAD 83), which is a common datum used in coordinate transformations to the State Plane Coordinate System. Transformation of station

coordinates from latitude and longitude to another coordinate system will be performed using Corpscon software.

Bank-Sampling Location Control:

Horizontal control for bank sampling will be accomplished using a combination of DGPS and other land-surveying or triangulation techniques.

Required equipment:

- Sampling and Analysis Plan
- coordinate list for bank segment boundary points
- bank topography map (electronic preferred)
- hand-held or backpack-mounted DGPS unit
- tide gauges/tide staffs (during sampling only)
- sledge hammer (or other device for driving stakes)
- survey stakes and lathe
- survey tape
- permanent black marker pens

Typical procedures:

1. Prior to sampling activities, stake the bank segment boundaries using the following general procedures:
 - a) Assemble all equipment on site and calibrate the DGPS equipment per the manufacturer's recommendations.
 - b) Use the DGPS unit to locate each predetermined bank segment boundary point.
 - c) Drive a survey stake and lathe at the boundary point and label the lathe with the segment number and a reference (north or south, head/mouth, inner/outer, etc.)

to indicate on which end of the segment the stake is located.

- d) Run survey tape between the boundary points and secure to the lathe (baseline).
- e) Use the tape measure to mark off 50-foot intervals on the baseline.
- f) Record pertinent information and activities in the site log book.

Note: In the shorter bank segments, the typical 50-foot spacing between boundary stakes may be adjusted to allow collection of more than one (1) sample. A minimum of two (2) samples should be obtained, if possible and practicable, to ensure a test sample that is representative of the bank segment conditions.

- 2. During sampling, the following general procedures will be used to obtain the location and elevation of bank-sampling locations
 - a) Assemble all sampling materials and equipment on site.
 - b) Calibrate DGPS equipment per the manufacturer's recommendations.
 - c) Move to the first sampling segment and locate the first mark on the baseline between the boundary stakes.
 - d) Use the tape measure or a piece of survey tape to pull a line perpendicular to the baseline at the first mark.
 - e) Move down the tape until an appropriate sampling area is located.
 - f) Place a temporary marker at the location and record the coordinates using the DGPS.
 - g) Collect the sediment sample.
- 3. After sampling is complete in the bank areas, the topography for the bank will be used to establish the elevation of each sampling site using the DGPS coordinates recorded in the field.

Note: The horizontal and vertical control in the tideflats area may be performed in

a similar manner if sampling is conducted on foot rather than using a small shallow-draft vessel. However, it is not critical that these locations be staked prior to sampling. All control activities may be conducted at the time of sampling.

Standard Operating Procedure 2

Site Logbook

Purpose:

This guideline describes the process for keeping a site logbook.

Scope:

The site logbook is a controlled document that records all major on-site activities. At a minimum, the following activities/events should be recorded in the site logbook:

- arrival/departure of site visitors
- arrival/departure of major site equipment (e.g., drill rigs)
- sample and waste shipment information (shipping manifests, chain-of-custody form numbers, carrier, air bill numbers, time)
- a summary of activities and logsheet numbers
- start or completion time of individual activities
- health and safety issues (e.g., level of protection, occurrence of incidents).

The site logbook is initiated at the start of the first on-site activity (e.g., initial reconnaissance survey). Entries are made each day that on-site activities take place involving remediation contractor personnel. One current site logbook is maintained per site.

The site logbook becomes part of the permanent site file maintained in the remediation contractor's office. Because information contained in the site logbook may be admitted as evidence in legal proceedings, it is critical that this document be properly maintained.

Definition:

Site logbook—The logbook is a bound notebook with consecutively numbered pages that cannot be removed. Upon entry of data, the logbook requires a signature by the responsible site leader or Field Operations Lead (FOL).

Responsibilities:

The Project Manager (or designee) issues the site logbook to the FOL for the duration of the project. The FOL releases the site logbook to field personnel responsible for the direction of on-site activities (e.g., Reconnaissance Survey Team Lead, Sampling Team Lead). It is the responsibility of this person (or designee) to keep the site logbook current while in his or her possession and to return it to the FOL or turn it over to another field team. Following the completion of all fieldwork, the site logbook is returned to the Project Manager for inclusion in the permanent site files.

Guidelines:

The cover of each site logbook shall contain the following information:

- project name
- FOL's name
- sequential book number
- start date
- end date

Daily entries into the logbook may contain a variety of information. At the beginning of each day, the following information must be recorded:

- date
- start time
- weather conditions
- all field personnel present
- any visitors present

During the day, a summary of all site activities and level of personal protective equipment should be recorded in the logbook. The information need not duplicate anything recorded in

other field notebooks (e.g., Site Health and Safety Officer's notebook, calibration logbook, etc.), but should summarize the contents of the other notebooks and refer to the page locations in these notebooks for detailed information.

If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the notebook and page number(s) on which they are recorded. All maintenance and calibration records for equipment should be traceable through field records to the person using the instrument and to the specific piece of instrumentation itself.

All entries should be made in black pen. No erasures are permitted. If an incorrect entry is made, the data should be crossed out with a single strike mark and initialed and dated. At the completion of entries by any individual, the logbook must be signed. The FOL or responsible site leader must also sign it at the end of each day.

Photographs:

Photographs taken at a site for the purpose of project documentation must be recorded in the site logbook or a field notebook. When movies, slides, or photographs are taken of a site or any monitoring location, they are numbered to correspond to logbook entries. The name of the photographer, date, time, site location, site description, and weather conditions are entered in the logbook as the photographs are taken. A series entry may be used for rapid-sequence photographs. The photographer is not required to record the aperture settings and shutter speeds for photographs taken within the normal automatic exposure range. However, special lenses, films, filters, and other image-enhancement techniques must be noted in the logbook. If possible, such techniques should be avoided because they can adversely affect the admissibility of photographs as evidence. Chain-of-custody procedures depend upon the subject matter, type of film, and the processing methods. Film used for aerial photography, confidential information, or criminal investigations require chain-of-custody procedures. Adequate logbook notations and receipts may be used to account for routine film processing. Once processed, the slides of photographic prints shall be serially numbered and labeled according to the logbook descriptions.

Standard Operating Procedure 3

Decontamination of Hand Sampling Equipment

Required Equipment:

Source-approved potable tap water
ASTM Type II, or equivalent, reagent deionized water
Laboratory-grade detergent (i.e., Liquinox, Alconox, or equivalent)
5-gallon buckets
Scrub brushes
Plastic sheeting
Garden and hand sprayers (plastic)

Typical Procedures

Preparation:

Set up decontamination area, including buckets, plastic sheeting, scrub brushes, sprayers.
Set up “clean” area upwind of decontamination area for air drying of equipment.
Fill one 5-gallon bucket with detergent and potable tap water.
Fill a second 5-gallon bucket with potable tap water only.
Fill new/clean spray bottles with deionized water (garden sprayer).

Decontamination of Sampling Equipment:

Scrub all sampling equipment to remove gross contamination.
Wash equipment in detergent.
Rinse with potable tap water.
Rinse with deionized water.

Note: If sticky or oily residues are observed during sampling, an acid/solvent rinse sequence (i.e., nitric acid (0.1 percent) and isopropanol) will be added prior to the final deionized water rinse.

Air dry.

Place disposable items (sampling gloves, paper towels, etc.) in garbage can, garbage bag, or

5-gallon bucket with lid.

Document activities in the site logbooks.

Note: All decontamination fluids will be contained in a tub or bucket for proper disposal (see Standard Operating Procedure 4).

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Standard Operating Procedure 4

Investigation-Derived Waste Handling

Solid Waste Handling:

Solid wastes needing to be containerized will be placed in 55-gallon drums or other approved containers at a central site location daily. Solid residues known to be from a contaminated area should not be combined with other residues.

After proper decontamination, protective clothing and used disposable sampling equipment should be drummed together and separated from other waste types. Protective clothing and disposable sampling equipment should be collected daily and placed in a dedicated drum for this waste type.

Decontamination liquids will be contained and placed in 55-gallon drums or other approved containers. Water containing hexane or other hazardous materials will be segregated for appropriate disposal, as necessary. Excess sediments from tideflats and subtidal sampling will be used to backfill sampling locations. Excess core sediment, if applicable, will be disposed of by the laboratory following core extrusion and logging.

All filled or partially filled drums must be properly closed, sealed, labeled, and staged before demobilization. If storage in excess of 2 weeks is anticipated, the drums should be covered with a wind/rain-resistant cover such as a plastic or polyethylene tarp.

Standard Operating Procedure 5

Shipping and Handling of Samples

Required Equipment:

Sampling and Analysis Plan, site logbook, sample logs, sample labels
Indelible black ink pens
Ziploc[®] bags
Cooler
Blue Ice[®] or other ice packs
Strapping tape or duct tape
Chain of custody forms
Custody seals
Bubble wrap, newspaper, or other packing material

Typical Procedures:

NOTE: Before packaging, all samples will be individually labeled and noted in the site logbook by the sampler. Labels will be completed with all required information (Section 4, Volume III). The samples will be assigned individual numbers that describe sample type and sample location. The sample numbers will be used to complete the chain-of-custody forms and track the samples.

Samples to be hand-delivered to the laboratory:

1. Place each sample in a plastic Ziploc[®] bag and align the label so it can be easily read. Seal the bag.
2. Place individual samples into the cooler so that each container is safely secured.
3. Include enough (four or more) ice packs to maintain a temperature of 4°C or lower.
4. Complete a chain-of-custody form for the containers and seal in a Ziploc[®] bag. Tape bag containing the chain-of-custody form to the inside of the cooler lid. Always transport the cooler together with its accompanying chain-of-custody form.

5. Close and latch cooler and affix signed custody seals over the edge of the lid and the top of the cooler body at front and rear.
6. Deliver samples to the laboratory and obtain a signed copy of the chain-of-custody form for tracking purposes.

Samples to be shipped to the laboratory:

1. Place each sample in a plastic Ziploc[®] bag and align the label so it can be easily read. Seal the bag.
2. Wrap each sample with bubble wrap, newspaper, or other packing material.
3. Place individual samples into the cooler so that the addition of Blue Ice[®] and/or packing materials will prevent significant movement of samples during shipping. Keep in mind that we cannot predict in what position the cooler will be shipped. Each container has clearance on all sides.
4. Fill the void spaces with ice packs, bubble wrap, newspaper, or other packing material to ensure samples do not break during shipment.
5. Cover the head space inside the cooler with ice packs.
6. Tape bag containing the chain-of-custody form to the inside of the cooler lid. Remember to remove the last copy of the form for tracking purposes.
7. Close and latch cooler, and wrap cooler and lid with at least two turns of strapping, duct, or packaging tape. Affix signed custody seals over the edge of the lid and the top of the cooler body at front and rear.
8. Label coolers with up arrows and information to comply with Department of Transportation requirements.
9. Notify the laboratory approximately when and how many samples will arrive. The samples must be kept under refrigeration (or packed with ice) between sampling and analysis.

Note: If samples are to be stored overnight before shipping, they must be secured in a

locked room or other inaccessible area. The cooler should be sealed with a signed and dated custody seal. Before shipping, the Blue Ice[®] in the cooler should be replaced and the cooler resealed according to the instructions in this Standard Operating Procedure.

Samples may be shipped in coolers or any other sturdy, water-tight, appropriate container. This Standard Operating Procedure refers to coolers for simplicity and because they are the most common type of transport container.

Standard Operating Procedure 6

Sediment Sampling Using a Van Veen Bottom Grab Sampler

Required Equipment:

Sampling and Analysis Plan, site logbook, sample labels, sample logs
Indelible black ink pens
Camera
Sample containers
Ziploc[®] bags
Aluminum foil
Unpowdered disposable gloves
Cooler and Blue Ice[®]
Van Veen Bottom Grab sampler (0.1 m, stainless steel with frame)
Hydraulic winch with power source
Hydrowire (or approved alternative), swivels, and shackles for sampler
Teflon[®] or Tygon[®] tubing and suction bulb (decanting water from sampler)
Stainless-steel bowls or buckets, spoons, or scoops
Tools for assembly and disassembly of equipment
Metal floats (to adjust sampler penetration, if necessary)
Stainless steel nuts, bolts, and washers
Sampler tray (large, flat plastic or metal tray used to stabilize sampler during sampling and to contain sediment emptied from sampler)
Decontamination equipment (see Standard Operating Procedure 3)

Typical Procedures:

Preparation:

Move sampling equipment and supplies to work vessel and assemble Van Veen Bottom Grab apparatus. The hydrowire should be attached to the sampler using a ball-bearing swivel or similar hardware to minimize twisting forces during deployment and retrieval.

For safety, the hydrowire, swivel, and shackles should have a load capacity at least three times the weight of the sampler. After assembly, secure the Van Veen sampler by placing it in the sampler tray and releasing the tension on the hydrowire.

NOTE: The Van Veen sampler should always be secured when the work vessel is in motion.

- Move work vessel to sampling location and anchor or hold on station using GPS data and navigation system.
- Record necessary data in site logbook, including date, time, and sampling station coordinates.

Procedure:

- Decontaminate the sampler in accordance with Standard Operating Procedure 7.
- Lock the sampler open with the safety pin and position over sampling location.
- Remove the safety pin, keeping hands and fingers outside the sampler. Deploy the sampler using the hydraulic winch and an overhead davit or boom. The sampler should be lowered at a controlled rate of speed approximately equal to 1 foot per second (ft/sec).

Note: Under no circumstances should the sampler be allowed to “free fall” to the bottom, as this may result in premature triggering, an excessive bow wake, or improper orientation of the sampler.

- After the sampler has triggered (check for stack wire), enclosing a sediment sample, retrieve the sampler at a controlled rate of speed approximately equal to 1 ft/sec.
- Lift the sampler carefully on board the work vessel and secure in large, flat pan or stand. Be careful not to swing or tip the sampler during retrieval.
- Open the sampler and evaluate the sample acceptability using the PSEP protocol. The following acceptability criteria should be satisfied:

1. The sampler is not over-filled so that sample is pressing against the top of the sampler.
2. Overlying water is present (indicates minimal leakage).
3. The overlying water is not excessively turbid (indicates minimal sample disturbance).
4. The sediment surface is relatively flat (indicates minimal disturbance or winnowing).
5. The desired penetration depth was achieved (10 to 20 cm for a 10-cm deep surficial sample).
 - For biological and chemical replicates, the difference in penetration depth between replicates within a station can be no more than 10 percent. Sampling must continue until the criteria are met. The following are minimum penetration depths.

Medium-coarse sand	4 to 5 centimeters (cm)
Fine sand	6 to 7 cm
Silt/clay	10 cm

Note: If the sample does not substantially meet the Puget Sound Estuary Program (PSEP) criteria, it should be rejected. The FOL will be responsible for all decisions regarding sample acceptability.

- Remove the water overlying the sediment sample. The preferable method for removing the water is by slowly siphoning it off near one corner of the sampler.
- Record the physical description of the sample in the site logbook. This description should include:
 1. Gross characteristics of the surficial sediment such as texture, color, biological structures present (shells, tubes, macrophytes), debris present (wood chips,

wood fiber, human artifacts), oily sheen present on the sample, and odor.

2. Gross characteristics of the vertical sediment profile, such as changes in any of the surficial characteristics listed above.
3. Penetration depth for the sample.
4. Comments related to sample quality such as leakage when the sampler retrieved, the presence of winnowing, or visible disturbance of the sediment.

Note: In order to obtain acceptable grab samples, it may be necessary to decrease the weight of the sampler (to reduce penetration). This can be done by removing the lead weights on the sampler and/or attaching metal (non-crush) floats to the frame. If weights are removed, the holes in the sampler should be plugged using stainless-steel nuts and bolts.

- Photograph the sediment.
- Remove any unrepresentative material from the sediment using a stainless-steel spoon or scoop and record this action in the site logbook. The types of materials considered unrepresentative should include large pieces (greater than 2 inches in diameter) of wood/bark, large shell fragments, man-made artifacts, and rocks.
- Don a clean pair of unpowdered (zinc-free) disposable gloves and collect the top 10 cm of sediment using a clean stainless steel spoon or scoop. Avoid contact with the sides of the sampler and do not touch the sediment sample with ungloved hands.

Note: Avoid airborne pollutants such as cigarette smoke or stack emissions from the work vessel.

- Place the sediment collected in a stainless-steel bowl or bucket and cover immediately with aluminum foil to prevent airborne contamination.
- Empty the sampler and repeat the sampling procedures until sufficient sediment is obtained for all required analyses. Be sure to record the total number of grabs taken at the sampling site.

Note: Excess sediment (and rejected sample) from the sampler should be carefully placed back into the water as far away from the sampling location as possible.

- When a sufficient sample has been obtained, gently composite the sediment grabs by carefully stirring with the sampling spoon/scoop. For biological stations where large volumes of sediments will be collected, a power drill fitted with a stainless-steel mixing paddle may be used to homogenize the sediment composite. The finished composite should be uniform in color and texture.

Note: Discrete sample aliquots for analysis of total sulfide and acid volatile sulfide will be collected from the first acceptable grab prior to removing sediment from the sampler. These samples should have zero headspace.

- Transfer the sediment to appropriate sample containers using a stainless steel spoon, scoop, or spatula, and seal.
- Label and manage the sample containers in accordance with Section 5.0 of the Sampling and Analysis Plan and Standard Operating Procedure 5 for shipping and handling of samples.
- Decontaminate the Van Veen sampler, Teflon[®] tubing, and sampling tools; secure the sampler; and move the work vessel to the next sampling location.

Note: The Van Veen sampler should always be decontaminated prior to leaving a sampling station to begin work at a new station. This prevents transport of sediments between the stations.

Standard Operating Procedure 7

Decontamination of Van Veen Sampler

Required Equipment:

Sampling and Analysis Plan, Site logbook
Indelible black ink pens
Source-approved potable tap water
Distilled water
Laboratory-grade non-phosphate detergent (Liquinox or equivalent)
Large plastic wash tub
5-gallon buckets
Scrub brushes
Garden sprayer(s) with wand and flow-adjustment/hand sprayers (plastic body and tip)
Hand sprayers
Hose assembly and salt water pump
Gloves and safety glasses

Typical Procedures:

Preparation:

- Fill a bucket or tub with potable tap water and add detergent.
- Fill a new/clean garden sprayer with distilled water.
- If possible, set up a hose assembly to provide ambient water for rinsing equipment.

Note: Prior to field work, the Material Safety Data Sheets (MSDSs) for all chemicals used in the sampling program should be reviewed as well as specific information in the Site Health and Safety Plan (SHSP) regarding these substances.

Decontamination of Van Veen Sampler:

- Don gloves and safety glasses prior to decontamination procedures. Staff should be

wearing protective coveralls, Tyvek suits, or rain gear at all times in the exclusion zone.

- Decontaminate spoons, buckets, Teflon[®] tubing, and other incidental sampling equipment (see Standard Operating Procedure 3) prior to decontaminating the Van Veen Sampler.
- After spoons and buckets have been decontaminated, suspend the Van Veen Sampler over the side of the work vessel and decontaminate the sampler tray using the procedures described in Standard Operating Procedure 3. The Van Veen sampler will be placed back in the clean tray following decontamination.
- Remove excess sediment from the Van Veen Sampler. This may be accomplished by gently agitating the sampler up and down in the water column beside the work vessel.
- Scrub the Van Veen Sampler, preferably while it is suspended just over the side of work vessel. If this is not possible due to rough seas, scrub the sampler in the tray or stand. Safety of the field staff should be the major constraint.

Note: The Van Veen sampler tends to collect sediment and debris in the square corners at the top and in the screens and flaps. Check these areas carefully.

- Rinse the sampler with ambient water while suspended over the side of the work vessel. If this is not possible due to rough seas, a garden sprayer may be used and the water may be collected in the sampler tray and emptied back into Puget Sound.
- If sticky or oily residue is observed, rinse with dilute nitric acid, deionized water, and isopropanol. Hexane will be available as a final backup rinse, if necessary.
- Rinse equipment with deionized water.
- Allow excess liquid on the equipment to evaporate if possible.
- Secure the Van Veen Sampler in the sampler tray.
- Document the decontamination procedures in the site logbook.

Note: All investigation-derived waste, including paper towels, disposable gloves, Tyvek suits, etc., should be placed in 5-gallon buckets with lids for transfer to 55-gallon drums or other appropriate containers in a central storage location on site per Standard Operating Procedure 4.

Standard Operating Procedure 8

Field Grain-Size Analysis (Wet Sieve Method)

Required Equipment:

100 ml graduate glass cylinder

#230 brass musk screen

Clean squeeze bottle

Spatula

Typical Procedures:

1. Place a 62.5 μm (4 phi or 0.0025-inch mesh or #230 mesh size) sieve in a funnel with a bowl underneath. Moisten the sieve using a light spray of distilled water.
2. Place exactly 50 ml of sample in the 100 ml graduated cylinder, add 20 to 30 ml of distilled water, and stir to fluidize the sample.
3. Pour the sample into the sieve and thoroughly rinse any residue from the 100 ml graduated cylinder and stir into the sieve.
4. Wash the sediment on to the sieve with distilled water using a water pique or squirt bottle having low water pressure. Aggregates can be gently broken using a rubber spatula.
5. Continue wet sieving until only clear water passes through the sieve. Take care to ensure that the rinsate does not exceed approximately 950 ml. This is accomplished by sieving an appropriate sample quantity (i.e., a sample volume that is not too large) and by efficient use of rinse water. Both of these techniques may require experimentation before routine wet sieving is started.
6. Upon completion of sieving, carefully return the contents (i.e., sand and gravel fraction) of the sieve to the 100-ml graduated cylinder.
7. Tap the graduated cylinder gently to settle the solid material.
8. Read the volume of solid material from the scale on the side of the graduated cylinder and record the value. The fraction of sample with grain size greater than

62.5 μm is the ratio of the volume of material retained in the sieve to the original volume (50 ml).

Standard Operating Procedure 9

Dioxin Sampling

Required Equipment:

- Sampling and Analysis Plan (with applicable Standard Operating Procedures)

Typical Procedures:

- Consult Sampling and Analysis Plan for sample locations.

Aqueous Samples:

- Samples collected for dioxin analysis may be taken using the appropriate methods for collecting other aqueous samples.
- Laboratory analysis requires a 1-liter volume collected in an amber glass bottle. It is important to use amber glass and to protect samples from light, as dioxin is affected by exposure to light.
- Cool samples to a temperature of 0°C to 4°C by placing in an insulated cooler and surrounding with ice packs.
- Label and manage sample containers in accordance with Standard Operating Procedures for shipping and handling of samples (Standard Operating Procedure 5).
- Decontaminate sampling equipment in accordance with Standard Operating Procedure for decontamination (Standard Operating Procedure 3).

Additional information pertaining to aqueous dioxin samples:

- If residual chlorine is present, add 80 mg $\text{Na}_2\text{S}_2\text{O}_3$ (sodium thiosulfate) per liter of water.
- If sample pH is greater than 9, adjust to pH 7-9 with sulfuric acid.
- Samples are placed in glass containers because dioxin congeners tend to adhere to plastics and Teflon[®]-coated surfaces.

Soil/Sediment Samples:

- Collect soil and sediment samples using conventional sampling techniques and equipment.
- If a composite sample is desired, collect the material into a stainless-steel bowl or bucket and homogenize it using a stainless-steel spoon.
- Samples collected require one full 8 ounce amber glass jar. Use a stainless-steel spoon to transfer homogenized material to sample container, and cool samples to a temperature less than 4°C by placing in an insulated cooler and surrounding with ice packs. Protect samples from light.
- Label and manage sample containers in accordance with Standard Operating Procedure for shipping and handling of samples (Standard Operating Procedure 5).
- Decontaminate sampling equipment in accordance with Standard Operating Procedure for decontamination (Standard Operating Procedure 3 and Standard Operating Procedure 7).

Marine Biota Samples:

- Collect marine biota samples using conventional sampling techniques and equipment.
- Using decontaminated utensils or clean un-powdered gloves, place sample in a pre-decontaminated borosilicate glass jar with Teflon[®]-lined lid. Alternatively, the marine biota samples may be wrapped in decontaminated aluminum foil (dull side in) and placed in a plastic Ziploc[®] bag.
- Cool samples to a temperature less than 4°C by placing in an insulated cooler and surrounding with ice packs. Protect samples from light.
- Label and manage sample containers in accordance with Standard Operating Procedure for shipping and handling of samples (Standard Operating Procedure 5).
- Decontaminate sampling equipment in accordance with Standard Operating

Procedure for decontamination (Standard Operating Procedure 3).

- Marine biota samples will be composited in the laboratory.

Standard Operating Procedure 10

Bioaccumulation Sampling—Crabs

Required Equipment—General:

- Sampling and Analysis Plan
- Site logbook
- Indelible black-ink pens and markers
- Ziploc[®] bags
- Pre-decontaminated heavy duty aluminum foil
- Ice chest and Blue Ice[®] (alternatively, dry ice may be used)
- Dry ice (optional)
- Sample labels and field forms
- Timepiece
- Work vessel
- Scientific collectors permit
- Clean un-powdered disposable gloves
- Balance or other weighing scale

Required Equipment—Species Specific:

Dungeness Crab Sampling:

- Crab pot (standard 12-inch by 18-inch by 18-inch sport fishing crab pots), line (minimum 200 feet), floats, and bait (fish, squid or clams).

Note: Commercial crab pots may be substituted for sport pots with approval from the FOL.

- Bait containers

- Measuring board or calipers

Preparation:

1. Gather all needed sample equipment, labels, forms, and logbook.
2. Ensure decontamination of necessary equipment.

Note: Pots and lines should be rinsed prior to use and between sampling stations using ambient water.

3. Move equipment to work vessel.
4. Record necessary data in site logbook including date, time, tide level, weather, and sampling station coordinates.

Typical Procedure

1. Locate sampling station.
2. Bait crab pot (may be done prior to arrival at station).
3. Check all escape entrances to ensure that they are working properly.
4. Lower crab trap to bottom, ensuring that sufficient line is available to "set" the trap on the bottom (so that it does not float).

Note: Three to six traps (pots) will be set in each sampling area with the primary fishing or soaking time beginning approximately 2 hours prior to high tide. This can be modified if other times are more productive in capturing samples.

5. Allow trap to fish or soak for about 2 hours. The traps will be pulled and checked. (If insufficient sample is collected, subsequent sampling will be attempted during another tide series.

Note: The time of fishing may be extended for several hours to determine if crabs can be caught in a particular sampling area.

6. Raise trap as quickly as possible.
7. Place trap on deck.
8. Measure crabs using calipers and retain any crabs greater than 6.25 inches (legal size) in length. The preference will be for females, although males will be retained if sufficient females are not available. A minimum of 3 crabs per composite sample will be collected. Note: Although Dungeness crabs are the target species, red rock crab (minimum size of 5 inches) may be used if they are

available in sufficient numbers.

Note: Heavy weight gloves should be worn when handling crabs to prevent injury.

9. Return crabs smaller than 6.25 inches to the water.
10. For retained crabs, measure, weigh, determine sex, and examine them for any discoloration, abnormalities, or lesions. Record information.
11. For retained crabs, quickly kill them by a sharp blow to the area below the eyestalks on the underside of the shell using an instrument free of gross (visible) contamination.
12. Double-wrap each retained whole crab in decontaminated, heavy duty aluminum foil (dull side in). A completed sample identification label should be taped to the outside of each aluminum foil package. All of the individual wrapped crabs (that will be composited) from a sampling station should be placed in individual Ziploc[®] bags. Complete and place a sample label for the composite sample on the outside of the bag. If samples will be received at the laboratory within 24 hours, place on Blue Ice[®] in an ice chest or cooler. If samples will be received at the laboratory within 48 hours, they should be placed on Blue Ice[®] in an ice cooler, then frozen as soon as possible.
13. Record all relevant information, including date, time, location, collector, bait, weather conditions, species, and length.
14. Transport crabs to shore and express delivery to laboratory. Shipping and handling procedures are presented in detail in Standard Operating Procedure 5.
15. In the laboratory, the muscle tissue (edible meat) and hepatopancreas (“crab butter”) from the crabs collected at each sampling station will be composited (excluding shells) and analyzed.

Note: The crabs should not be cooked prior to analysis.

Standard Operating Procedure 11

Bioaccumulation Sampling—Flatfish

Required Equipment—General:

- Sampling and Analysis Plan
- Site logbook
- Indelible black-ink pens and markers
- Ziploc[®] bags
- Pre-decontaminated heavy duty aluminum foil
- Precleaned borosilicate wide-mouth glass jars with Teflon[®] sealer lids (optional)
- Sample labels and field forms
- Ice chest and Blue Ice[®]
- Dry ice (optional)
- Timepiece
- Work vessel
- Scientific collector's permit
- Clean disposable latex gloves
- Balance or other weighing scale
- Hook and line fishing gear
- Measuring board
- Identification key
- Decontaminated ice pick or other sharp instrument to kill fish

Note: Beach seine will be an alternative or supplemental method for harvesting fish as

approved by the FOL.

Preparation:

1. Gather all needed sample equipment, labels, forms, and logbook.
2. Ensure decontamination of necessary equipment
Note: Decontamination procedures are discussed in detail in Standard Operating Procedure 3.
3. Move equipment to work vessel.
4. Record necessary data in site logbook including date, time, tide level, weather, and sampling station coordinates.

Typical Procedure:

1. Locate sampling station.
2. Bait each hook (may be done prior to arrival on station). If specified in the Sampling and Analysis Plan, one sample of the bait may be retained for analysis to ensure that cross contamination by consumption of bait has not occurred.
3. Lower line to bottom, ensuring that sufficient line is available to "set" the line on the bottom (so that it does not float).
4. When a fish is hooked, retrieve and raise line and remove fish. Handle fish wearing clean disposable gloves or decontaminated heavyweight work gloves.
5. Measure fish using standard measuring board (measure to nearest mm), retaining any fish greater than 5 or 6 inches (125 to 150 mm) in length (approximate). The intent is to obtain specimens of the same species and of similar size range. The priority target species is the English sole. Alternative species include the rock sole, sanddabs, and starry flounder. At each sampling location, a minimum of 3 fish of one species will be retained for compositing for metals analysis and for other contaminants of potential concern.
6. Return fish smaller than 5 or 6 inches to the water.
7. For retained fish, quickly kill them by inserting a decontaminated ice pick or similar instrument to the area behind the eye and toward the top of the head. For retained fish, measure, weigh, and examine for abnormalities or lesions. Otoliths (2 per fish) will be removed using decontaminated utensils. The otoliths will be placed in small vials, labeled, and stored for later analysis.

Note: Retained fish will be handled with decontaminated utensils, decontaminated gloves, or clean disposable gloves.

8. Wrap each retained whole fish in decontaminated, heavy-duty aluminum foil (dull side in). All of the individual wrapped fish from a sampling station should be placed in individual Ziploc[®] bags. A completed sample identification label should be placed inside the plastic bag. Complete and place a sample label for the composite sample on the outside of each bag. If samples will be received at the laboratory within 24 hours, place on Blue Ice[®] in an ice chest or cooler. If samples will be received at the laboratory within 48 hours, they should be placed on Blue Ice[®] in an ice cooler, then frozen as soon as possible.

Note: Alternatively, all retained fish that will be composited can be place in a wide-mouth glass jar.

9. Record all relevant information, including date, time, location, collector, limit, weather conditions, species, length (in mm), and weight (gm).
10. Transport fish to shore for express delivery to laboratory. Shipping and handling procedures are addressed in detail in Standard Operating Procedure 5.
11. In the laboratory, the fish samples will be homogenized and analyzed. The fish should not be cooked prior to analysis.

Standard Operating Procedure 12

Bioaccumulation Sampling—Clams

Required Equipment

- Sampling and Analysis Plan
- Site logbook
- Indelible black-ink pens and markers
- Sample containers (i.e., Ziploc[®] bags and pre-decontaminated borosilicate jars with Teflon[®] sealer lids)
- Clam fork and shovel
- Decontamination equipment in accordance with Standard Operating Procedure 3
- Ice chest and Blue Ice[®]
- Dry ice (optional)
- Brush
- Deionized water
- Ruler
- Sample labels and field forms
- Camera (underwater – disposable)
- Scientific collector's permit

Additional Required Equipment for Underwater Sampling

- Work boat (if needed)
- SCUBA Gear (two divers minimum plus one safety officer in work boat)
- Venturi pump or hydraulic pump

- Cell phone (for emergency situations)

Typical Procedure

Preparation:

1. Gather all needed sample equipment, labels, forms, and logbook.
2. Ensure decontamination of necessary equipment, according to Standard Operating Procedure 3.
3. Move equipment to beach sample area or work boat.
4. Record necessary data in site logbook including date, time, tide level, weather, and sampling station coordinates.

Collect and Field Process Shellfish:

1. Determine exact sampling location.
2. Take photos of undisturbed site.
3. Collect clams by use of a clam rake, shovel, hydraulic pump, or hand. Retain only undamaged specimens.
 - a. Collect 8 to 10 butter clams (*Saxidomus giganteus*) of similar size (sufficient for shucked weight of 250 to 750 grams wet weight) at each of three locations within each sampling location (e.g., Port Angeles or the reference site). The amount of clams needed will vary depending on needs for matrix spike/matrix spike duplicate.
 - b. Clams should be of legal size (at least 1.5 inches long). Record species and lengths of clams retained.
 - c. If insufficient butter clams are available, littleneck clams (*Protothaca staminea*) will be collected.
4. Clams should be brought to the surface.
5. In the field, if necessary, outer shells will be rinsed with ambient water and scrubbed lightly to remove sediment.
6. Place clams in precleaned 16 oz. borosilicate glass jars with Teflon[®]-lined lids. (Alternately, they may be wrapped in decontaminated heavy-duty aluminum foil (dull side in). Place a sample label on the outside of the glass jar. Place each glass jar in a Ziploc[®] bag. If samples will be received at the laboratory within 24 hours, place on Blue Ice[®] in an ice chest or cooler. If samples will be received at the laboratory within 48 hours, they should be placed on blue ice in

an ice cooler, then frozen as soon as possible.

7. Complete all forms, including chain-of-custody forms. Transport clams to shore (if applicable) and express delivery to laboratory. Shipping and handling procedures are addressed in detail in Standard Operating Procedure 5.
8. In the laboratory, the clam samples will be homogenized and analyzed. Sample processing of clams in the laboratory will include all associated liquid in the respective jars.

Note: The clams should not be cooked prior to analysis.

STANDARD OPERATING PROCEDURE 13

VIBRACORE SAMPLING

Required Equipment:

- Work Plan, field logbook, sample logs, sample labels, clear tape
- Indelible black ink pens
- Camera
- End caps for Vibracore sleeves
- Electrical tape, duct tape, aluminum foil
- Vibracore apparatus
- Sample shipping containers
- Ice
- H₂S monitor
- Tape measure

Procedures:

1. Deploy an oil absorbent boom around the sampling area.
2. The coring vessel is maneuvered over the approximate position for the core by the vessel operator, and the water depth and bottom slope determined.
3. The corer is suspended from the vessel's A-frame or davit and lowered to the bottom.
4. After successful deployment, the vibratory head is engaged and the desired penetration is obtained.
5. Record penetration reading before the sample is retrieved.
6. The core is extracted from the sediment and the vibracore is recovered and stowed.
7. The core, with contained sediment, is removed from the driving head and transferred to a processing rack. (**NOTE:** Check H₂S in the work space prior to proceeding)
8. Inspect the lower end for sediment. Measure the distance from the tip of the core catcher to the bottom of the sediment. Measure this distance on the outside of the core

- tube from the tip of the core catcher, and make a mark with an indelible marker. Cap and wrap the end with aluminum foil and duct tape.
9. Lower a measuring stick or tape into the tube through the top opening until it meets the sediment surface. Note the distance from the top of the core tube to the top of the sediment. Mark the measuring stick where it meets the top of the core tube and bring the measuring stick to the outside of the core tube. Place the stick next to the tube, holding the measured amount of the stick at the top of the core tube again. Make a mark with an indelible marker on the outside of the tube where the bottom of the measuring stick is.
 10. Measure the distance between the two marks. Note this measurement in the field logbook and/or on the core log sheet. If the core fails to capture enough sediment, a second core may be taken.
 11. The tube is positioned in the rack to allow cutting at/near the top of the core and the tube is securely clamped to the rack.
 12. The excess core tube is cut off using a tube cutter. Two persons are required, one to operate the tube cutter and a second to hold onto the segment being removed.
 13. The core is marked for cutting into desired segments, positioned in the core rack, and cut. As segments are removed, they are capped and sealed, labeled, and stowed in a core storage box. This box is insulated and can be covered if segment length is less than four feet. Ice should be placed within the box to cool the samples to 4°C.
 14. As necessary, the deck is washed down (to prevent cross-contamination of sediments and personnel), with material collected and prevented from entering the creek.
 15. Equipment is secured and the vessel is moved to the next sampling site.

Core Acceptance Criteria:

1. A continuous core sample will be collected to the designated coring depth or until refusal.
2. The depth of core penetration will be measured and recorded.
3. The core sample will be evaluated at the visible ends of the core tube to ensure that retrieved sediment reached the required penetration depth. Sample recovery will be

inspected relative to the following acceptance criteria:

- a) Overlying water is present and the surface is intact;

- b) Calculated compaction is not greater than 25 percent; and
- c) The core tube appears intact without obstruction or blocking.

STANDARD OPERATING PROCEDURE 14

CORE PROCESSING

Required Equipment:

- Work Plan, field logbook, sample logs
- Pre-cleaned sample jars, sample labels, clear tape
- Indelible black ink pens
- Camera
- Aluminum foil
- Extrusion apparatus
- Sample shipping containers
- Ice
- Tape measure

Procedures:

1. Place the core on the cutting stand and extrusion table. Remove the duct tape and aluminum foil from the top of the tube. Be careful not to disturb or lose sediment.
2. Extrude core sections by tilting and/or vibrating the core section and letting the sediment slide out slowly. If necessary, a clean, fabricated stainless steel plunger can be used to push the core onto the table.
3. Remove the sediment in contact with the edges of the core tube by peeling or scraping off a layer of sediment, approximately 0.5 cm in depth, around the exposed circumference of the sample. Slice 2.5 cm of sediment off each end of the section that may have been in contact with the pipe cutter and plunger.
4. Note stratification of color or texture in the field logbook and/or on the core log sheet. Also make note of debris, odor, sheen, biology, soil density and other distinguishing characteristics.

5. Collect samples for volatile organics analysis and acid volatile sulfides. The immediate removal of these samples will minimize potential volatilization of constituents. The jars will be filled so there is no headspace. Place in cooler containing ice.
6. Transfer the remaining sediment to a stainless steel bowl. Stir with a spoon until the sample is of uniform color and texture. Remove debris (e.g., rocks, shells) and note on the sample description forms.
7. Collect samples for remaining chemical analyses and place in cooler.
8. Collect sample for soil characteristic analyses (e.g., total organic carbon, grain size). Place in cooler.
9. Seal each glass container in a plastic bag in case of breakage. Pack samples to minimize the chances of breaking. Decontaminate the core sampling equipment and move to the next station location.

Standard Operating Procedure 15

Bioaccumulation Sampling – Shrimp

Required Equipment – General

- Sampling and Analysis Plan
- Site logbook
- Indelible black-ink pens and markers
- Ziploc® bags
- Pre-decontaminated heavy duty aluminum foil
- Ice chest and Blue Ice® (alternatively , dry ice may be used)
- Dry ice (optional)
- Sample labels and field forms
- Timepiece
- Work vessel
- Scientific Collector's Permit
- Clean un-powdered disposable gloves
- Balance or other weighing scale

Required Equipment – Species Specific:

- Dissecting needle or similar piercing tool
- Shrimp pot (standard sport fishing shrimp pot), line (minimum 200 feet – leaded line), floats (must meet legal requirements), and bait (fish, squid, clams, or other)

Note: commercial shrimp pots may be substituted for sport pots with approval from the FOL.

- Bait containers
- Measuring board and calipers
- Small mesh trawl

Preparation:

1. Gather all needed sample equipment, labels, forms, and logbook.
2. Ensure decontamination of necessary equipment. Note: pots and lines should be rinsed prior to use and between sampling stations using ambient water.
3. Move equipment to work vessel.
4. Record necessary data in site logbook including date, time, tide level, weather, and sampling station coordinates.

Typical Procedure – Shrimp Pot

1. Locate sampling location.
2. Bait shrimp pot (may be done prior to arrival at station)
3. Check all escape entrances to ensure that they are working properly.
4. Lower shrimp pot to bottom, ensuring that sufficient line is available to “set” the pot on the bottom (so that it does not float). Note: up to 10 pots will be set in each sampling area with the main fishing or soaking time beginning near dusk. This can be modified if other times are more productive in capturing samples.
5. Allow the pots to fish or soak for about 2 hours. The pots will be pulled and checked. (If insufficient numbers of shrimp are collected, subsequent sampling will be attempted). Note: the time of fishing may be extended or adjusted depending on level of capture at each sample location.)
6. Raise the pot as quickly as possible.
7. Place the pot on deck.
8. Sort shrimp by species, retaining only targeted species
9. Measure each targeted shrimp using calipers and retain any legal-size shrimp (group as to species). Return any non-legal size shrimp to the water.
10. For retained shrimp, quickly kill them by inserting a dissecting needle into the head area Measure the length from the base of the eyestalk to the top rear of the carapace,

weigh the shrimp, and examine them for any discoloration, abnormalities, or lesions. Record the information.

11. A minimum of 10 shrimp per composite sample will be collected. Note: although coonstripe shrimp are the target species, spot shrimp may be used if they are available in sufficient numbers.
12. Remove the entire tail section (from the tip of the tail to the back edge of the carapace).
13. Group the shrimp by species and sampling location. Double-wrap each group in decontaminated aluminum foil (dull-side in). A completed sample identification label should be taped to the outside of each aluminum foil package. All of the shrimp that will be composited from a sampling location should be placed in individual Ziploc® bags. Complete and place a sample label for the composite sample on the outside of the bag. If samples will be received at the laboratory within 24 hours, place on Blue Ice® in an ice chest or cooler. If samples will be received at the laboratory within 48 hours, they should be placed on Blue Ice® in an ice cooler, then frozen as soon as possible.
14. Record all relevant information including date, time, location, collector, bait, weather conditions, species, and length.
15. Transport shrimp to shore and express delivery to laboratory. Shipping and handling procedures are presented in detail in SOP 5.
16. In the laboratory, the shell will be removed from the tail and the tail meat will be composited and analyzed for each data point. Note: shrimp should not be cooked prior to analysis.

Typical Procedure – Trawl

Trawling will be an alternate means for catching shrimp (and other species). Short trawls with a small mesh net will be conducted at each sampling location (e.g., Port Angeles, Dungeness Bay, or Freshwater Bay). The most likely trawl net will be a 7.6-meter SCCRWP net that will be fished for 5 minutes or less (depending on availability of sample organisms). When the trawl is brought on board, shrimp will be separated by species (using gloves to ensure that there is no direct contact with the shrimp). The shrimp will be separated as to species and processed the same as above for shrimp captured by pots.